UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b)

Attorney Docket No.	P99,0601
First Named Inventor or Application Identifier	
Hiroaki Ooki	
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ADDRESS TO: **Assistant Commissioner for Patents**
Box Patent Application
Washington, DC 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. X Specification [Total Pages 19]
2. X Drawing(s) (35USC 113) [Total Pages 3]
3. X Declaration and Power of Attorney [Total Pages 2]

a. __ Newly executed declaration (Original copy)

b. __ Copy from prior application (37CFR 1.63(d))
(for continuation/divisional with Box 14 completed)

[Note Box 4 Below]

i. __ DELETION OF INVENTOR(S)
Signed statement attached deleting Inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

4. __ Incorporation By Reference (usable if Box 3b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 3b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

ACCOMPANYING APPLICATION PARTS

5. __ Assignment Papers (cover sheet & documentation) ______
6. X Letter under 37 CFR 1.41(c).
7. __ English Translation Document *(if applicable)*
8. __ Information Disclosure Statement (IDS)/PTO-1449 __ Copies of IDS Citations
9. X Preliminary Amendment
10. X Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
11. __ Small Entity Statement(s) __ Statement filed in prior application, Status still proper and desired (Faxed copy of original)
12. X Certified Copy of Priority Document(s) Japanese Aplication No. P10-156944 filed June 5, 1998
13. __ Other:

14. If a CONTINUING APPLICATION, *check appropriate box and supply the requisite information:*

__ Continuation __ Divisional __ Continuation-in-part (CIP) __ of prior application No: __/

CLAIMS AS FILED

(1) FOR		(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) BASIC FEE $760.00
TOTAL CLAIMS	20	5			
INDEPENDENT CLAIMS	3	3			
		ANY MULTIPLE DEPENDENT CLAIMS? ()YES (X) NO			
				TOTAL FILING FEE ->	$760.00

X The Commissioner is hereby authorized to charge any additional fees which may be required in connection with this application, or credit any overpayment to ACCOUNT NO. 08-2290. A duplicate copy of this sheet is enclosed.

X A check in the amount of $ 760.00 to cover the filing fee is enclosed.

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491:1190 U-11

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June 3, 1999

Assistant Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Re: Our Case No. P99,0601
Inventor: Hiroaki Ooki
For: A CHARGE TRANSFER DEVICE AND A DRIVING METHOD THEREOF AND A DRIVING METHOD FOR SOLID-STATE IMAGE SENSING DEVICE

S I R:

Under the provisions of 37 CFR 1.41(c), I am filing the attached application 5 claims, Figures 1-6 on 3 sheets and $760.00 filing fee on behalf of

Hiroaki Ooki

and request that the application be assigned a Serial Number and filing date pursuant to the provisions of 37 CFR 1.53(b) and 37 CFR 1.53(d).

Respectfully submitted,

John D. Simpson (Reg. No. 19,842)
FOR THE FIRM

491/1077
Enclosures

A CHARGE TRANSFER DEVICE AND A DRIVING METHOD THEREOF AND A DRIVING METHOD FOR SOLID-STATE IMAGE SENSING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a charge transfer device, such as a CCD and a driving method thereof, and a driving method for a solid-state image sensing device, in particular, it relates to a driving method for CCD solid-state image sensing devices of an IT (Inter-line Transfer) type.

In general, in a CCD solid-state image sensing device of the IT type, when signal charges are transferred, for example, by a vertical charge transfer portion (vertical shift register) having transfer electrodes of four systems, the transfer of signal charges for one line is performed in a horizontal blanking interval, and normally it is performed in a vertical transfer period being composed of eight sectional periods. In respective sectional periods, each one of four transfer electrodes is selectively applied with a high level driving pulse to control a depth of a potential well which is formed under each one of transfer the electrodes of respective systems, and the transfer of signal charges in a vertical direction is realized with the moves of signal charges described in the above. In a

case where a read-out method in the interlaced scanning is changed to the read-out method in which all pixels are independently read out, or in a case where a constitution of a CCD solid-state sensing device responds to an electronic zoom lens or correction of blur caused by an unintentional hand move, it is needed to perform the charge transfer in the vertical charge transfer portion at a higher speed than usual.

However, when the transfer speed in the vertical charge transfer portion is made faster, with an increase in the transfer speed, the period of time for accumulating the charges in the vertical charge transfer portion is made shorter. Then the quantity of charges handled in the vertical charge transfer portion is decreased, and there is a fear that the transfer efficiency is lowered. In particular, for a CCD area sensor, there is a tendency that an increase in the number of pixels is demanded to realize high quality images in both a moving picture and a still picture. It is therefore necessary to take measures to such demands as the independent read-out of all pixels, or the improvement in techniques for an electronic zoom lens or correction of blur caused by an unintentional hand move, following to the upward tendency of requiring the increase in the number of pixels. Therefore, it looks

inevitable that the transfer speed in the vertical charge transfer portion will continue to go up, so that it is desired to find an effective measure to suppress the decrease in the handling charge quantity in the vertical charge transfer portion.

SUMMARY OF THE INVENTION

The object of the present invention is to solve the aforementioned problems by providing a charge transfer device and a driving method thereof and a driving method for a solid-state image sensing device, more particularly, by providing a driving method for a solid-state image sensing device being able to suppress the decrease in the handling quantity of electric charges to the utmost when transferring signal charges at a high speed in the vertical charge transfer portion.

In order to achieve the object described in the above, according to an aspect of the present invention, there is provided A driving method for a solid-state image sensing device having a plurality of sensor portions being disposed two-dimensionally in a horizontal and a vertical directions, and a vertical charge transfer portion being disposed between the plurality of sensor portions and being provided with transfer electrodes of a plurality of systems disposed along its disposed

direction, including the steps of; selectively applying high level driving pulses to the transfer electrodes of the plurality of systems in respective sectional periods in a vertical transfer period, and transferring the signal charges read out from the plurality of sensor portions in the vertical direction, wherein a sectional period in a vertical transfer period, in which the number of systems of the transfer electrodes to be applied with high level driving pulses becomes minimum is set longer than that of the other sectional periods.

According to another aspect of the present invention, there is provided a driving method for a charge transfer device having a charge transfer portion being formed of transfer electrodes of a plurality of systems disposed in the charge transfer direction, comprising the steps of; selectively applying a high level driving pulse to transfer electrodes of the plurality of systems in respective sectional periods in a transfer period, and transferring signal charges in a charge transfer portion, wherein a sectional period in the transfer period, in which the number of systems of the transfer electrodes to be applied with high level driving pulses becomes minimum are set longer than that of the other sectional periods.

According to a further aspect of the present

invention, there is provided a charge transfer device having a charge transfer portion being formed of transfer electrodes of a plurality of systems disposed in the charge transfer direction; wherein high level driving pulses are applied to the transfer electrodes of the plurality of systems in respective sectional periods in a vertical transfer period, signal charges in a charge transfer portion are transferred, and a sectional period in a vertical transfer period, in which the number of systems of the transfer electrodes to be applied with high level driving pulses becomes minimum is set longer than that of the other sectional periods.

As described in the above, according to the present invention, it is made possible to increase the handling charge quantity in the vertical charge transfer portion without changing time for transfer in the vertical transfer period, so that in a case where signal charges are transferred at a high speed in the vertical charge transfer portion, for example, in a case of response to the read-out of all pixels being output independently, to the improvement of techniques in an electronic zoom lens or the correction of blur caused by an unintentional hand move, or to an increase in the number of stages in the vertical transfer, it is made possible to suppress the decrease in the handling charge quantity to the utmost.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing the constitution of a CCD area sensor of an IT type and its driving system;

Fig. 2 shows a timing chart during a vertical transfer in the case of 4-phase drive which is a subject of comparison with the present invention;

Fig. 3 shows a conceptual figure illustrating the transfer of signal charges during a vertical transfer in the case of 4-phase drive;

Fig. 4 shows a figure illustrating a correlation between a handling charge quantity and a transfer speed in the vertical charge transfer portion;

Fig. 5 shows a timing chart during a vertical transfer in the case of 4-phase drive shown in an embodiment according to the method in the present invention;

Fig. 6 shows an illustrative drawing for explaining the suppression effect for the decrease in the handling charge quantity according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An explanation of embodiments of the present invention will be given in detail with reference to the drawings as follows.

Fig. 1 shows a schematic view illustrating the constitution of a CCD area sensor of an IT type and its driving system. In the figure, a sensor portion 1 is formed of namely, photodiodes being disposed two-dimensionally in a horizontal and a vertical directions. Each sensor portion 1 converts the incident light supplied thereto to signal charges having the quantity corresponding to the light quantity and accumulates them. Plural bars of vertical charge transfer portions 2 are disposed in the vertical direction between respective sensor portions 1. Each vertical transfer portion 2 is formed of a CCD (Charge Coupled Device), and the transfer electrodes of four systems are disposed along its disposed direction. These vertical charge transfer portions 2 are driven by vertical driving pulses of 4-phase from ϕV1 through ϕV4, supplied from a driving circuit 3, and in a part of the vertical blanking interval, it transfers the signal charges read out from respective sensor portions 1 through the read-out gate portion 4.

Further on an end side of respective vertical charge transfer portions 2, there is provided a horizontal charge transfer portion 5 in the orthogonal direction to the above, that is, in the horizontal direction thereof. The horizontal charge transfer portion

5 is driven by horizontal driving pulses ϕH1 and ϕH2 of 2-phase supplied from the driving circuit 3, for transferring the signal charges supplied from the vertical charge transfer portions 2 in the horizontal direction for a specific period of time in a horizontal scanning interval, for example, during a horizontal blanking interval. On the output side of the horizontal charge transfer portion 5 (that is, the charge transferring direction) there is provided a charge detection portion 6 formed of an FDA (Floating Diffusion Amplifier), for example, for detecting signal charges transferred in the horizontal direction and converting them into signal voltages.

Next, in Fig. 2, the timing chart during a vertical transfer in the case of 4-phase drive is shown, and in Fig. 3, the transfer image of signal charges corresponding to the above as a subject of comparison with the driving method of a solid-state image sensing device according to the present invention. In this place, a case where it is assumed that respective vertical driving pulses of 4-phase, ϕV1 to ϕV4 may take two values, a high level (H) or a low level (L), and the transfer of signal charges for one line is performed in a vertical transfer period being divided into eight sections, from t1 through t8, will be explained in citing

as an example. In Fig. 3, it is assumed that the vertical driving pulses ϕV1, ϕV2, ϕV3 and ϕV4 are applied by the driving circuit 3 to the corresponding transfer electrodes ϕ1, ϕ2, ϕ3 and ϕ4 of 4 systems in the vertical charge transfer portion 2.

In the sectional period t0, before the vertical transfer is started, since the ϕV1 and the ϕV2 are kept in a high level, deep potential wells are formed under the transfer electrodes ϕ1 and ϕ2, allowing signal charges to be accumulated in these wells, and in this state, a vertical transfer period (from t1 through t8) is started.

In the sectional period t1, when ϕV3 is turned to a high level, deep potential wells are formed spreading over the transfer electrodes ϕ1, ϕ2 and ϕ3, and signal charges are accumulated under these transfer electrodes ϕ1, ϕ2 and ϕ3.

Next, in the sectional period t2, when the ϕV1 is turned to a low level, the potential well under the transfer electrode ϕ1 becomes shallow, so that signal charges are accumulated under the transfer electrodes ϕ2 and ϕ3.

In the next step, in the sectional period t3, when the ϕV4 is turned to a high level, deep potential wells are formed spreading over the transfer electrodes ϕ2, ϕ3

and $\phi 4$, so that signal charges are accumulated under these transfer electrodes $\phi 2$, $\phi 3$ and $\phi 4$.

Following to the sectional period t3, in the sectional period t4, when the $\phi V2$ is turned to a low level, the potential well under the transfer electrode $\phi 2$ becomes shallow, so that signal charges are accumulated under the transfer electrodes $\phi 3$ and $\phi 4$.

In the next step, in the sectional period t5, when the $\phi V1$ is turned to a high level, deep potential wells are formed spreading over the transfer electrodes $\phi 3$, $\phi 4$ and $\phi 1$, so that signal charges are accumulated under these transfer electrodes $\phi 3$, $\phi 4$ and $\phi 1$.

In the next step, in the sectional period t6, when $\phi V3$ is turned to a low level, the potential well under the transfer electrode $\phi 3$ becomes shallow, so that signal charges are accumulated under the transfer electrodes $\phi 4$ and $\phi 1$.

Incidentally, in the sectional period t7, when the $\phi V2$ is turned to a high level, deep potential wells are formed spreading over the transfer electrodes $\phi 4$, $\phi 1$ and $\phi 2$, so that signal charges are accumulated under these transfer electrodes $\phi 4$, $\phi 1$ and $\phi 2$.

In the last step, in the sectional period t8, when the $\phi V4$ is turned to a low level, the potential well under the transfer electrode $\phi 4$ becomes shallow, so that

signal charges are accumulated under the transfer electrodes $\phi 1$ and $\phi 2$.

After taking above steps, the signal charges for one line in the vertical charge transfer portion 2 are transferred in a vertical direction.

In order to raise the transfer speed in the vertical charge transfer portion 2, it is necessary to shorten the transfer time T, the total of the above-mentioned eight sectional periods in a vertical transfer period. In such a case, in the driving method shown in Fig. 2, in each sectional period from t1 through t8 in a vertical transfer period, the transfer time per sectional period is made equal, so that when the transfer time for one line is shortened, naturally the sectional transfer period is also shortened.

At the same time, there is a tendency that the handling charge quantity in the vertical charge transfer portion 2 decreases with the shortening of the transfer time per sectional period.

Fig. 4 shows a figure illustrating a correlation between the handling charge quantity and the transfer speed (Hereinafter it can be referred to as $V\phi$ speed). In the figure, a period of a certain reference clock pulse is put as 1-bit and the transfer speed is expressed with the number of bits in a sectional period, and when

the number of bits is smaller (closer to zero), a faster transfer speed is expressed. From the figure, one will be able to perceive that faster is the transfer speed (shorter the transfer time per sectional period) smaller becomes the handling charge quantity.

When the handling charge quantity in the vertical charge transfer portion 2 decreases, even if a lot of signal charges are accumulated in the sensor portion 1, there is a fear that the vertical charge transfer portion 2 may become unable to transfer all the signal charges accumulated therein, and so called the left-off charges may be produced causing the deterioration of the transfer efficiency.

In the present embodiment, taking note of the fact that the handling charge quantity in the vertical charge transfer portion 2 depends on the magnitude of the charge accumulation area in the transfer direction, or in the vertical direction, and further the magnitude of the charge accumulation area in the transfer direction depends on the number of systems of the transfer electrodes under which deep potential wells are formed, a driving method as explained in the following is adopted.

When the case where signal charges for one line are transferred in the vertical direction in eight sectional periods (from t1 through t8) using the vertical driving

pulses ϕV1, ϕV2, ϕV3 and ϕV4 of 4-phase is cited as an example, among these sectional periods from t1 through t8, periods t2, t4, t6 and t8 in which the number of systems of transfer electrodes applied with vertical driving pulses of a high level becomes minimum becomes two.

When the vertical charge transfer portion 2 is driven, the sectional periods in which the vertical driving pulses become a high level and the number of systems of transfer electrodes becomes minimum are set longer than the others. To be concrete, as shown in the timing chart in Fig. 5, the sectional periods t2, t4, t6 and t8 in which the number of systems of transfer electrodes applied with vertical driving pulses of a high level becomes two are set longer than the sectional periods t1, t3, t5 and t7 in which the number of systems of transfer electrodes applied with high level driving pulses becomes three. Provided that the transfer time T, the total of eight sectional periods, is set to be the same as that in the timing chart shown in Fig. 2. In short, in comparison with the timing chart shown in Fig. 2, corresponding to the extended period of time for each sectional period of t2, t4, t6 and t8, the time for each sectional period of t1, t3, t5 and t7 is shortened.

As mentioned in the above, the sectional periods t2, t4, t6 and t8, in which the number of systems of the

transfer electrodes to be applied with vertical driving pulses in a high level becomes minimum are set longer than the other sectional periods t1, t3, t5 and t7, therefore, in the sectional periods t2, t4, t6 and t8, a larger charge accumulation area in the transfer direction can be secured than that in other sectional periods.

In the sectional periods t1, t3, t5 and t7, the number of systems of transfer electrodes to be applied with vertical driving pulses in a high level becomes three, so that in consideration of the balance with the number of systems, these sectional periods are shortened in order that the magnitude of the charge accumulation area in the transfer direction is not smaller than that in the periods t2, t4, t6 and t8, which makes it possible to avoid the influence on the handling charge quantity in the vertical charge transfer portion 2.

Owing to the arrangement explained in the above, it is made possible to increase the handling charge quantity in the vertical charge transfer portion 2 without changing the total transfer time of eight sectional periods in a vertical transfer period, so that, for example, to respond to the correction of blur caused by an unintentional hand move, even if signal charges are transferred at a high speed in the vertical charge transfer portion 2, it is possible to control the

decrease in the handling charge quantity to the utmost.

The verification of the degree of improvement in comparing two kinds of timings were carried out by actually driving the transfer electrodes in the vertical charge transfer portion 2 using the same CCD solid-state image sensing device with the driving timing shown in Fig. 2 and the driving timing shown in Fig. 5, and the results obtained are shown in Fig. 6.

In Fig. 6, the results corresponding to the driving timing shown in Fig. 2 are shown with black circles and those corresponding to that shown in Fig. 5 are shown with white circles. About the transfer speed (Vϕspeed), the extended period of time in sectional periods, t2, t4, t6 and t8 is denoted by 1-bit and the transfer time per sectional period is expressed on bit basis. It means that, for example, at the position denoted by a downward arrow indicates that 4 bits are transferred per sectional period, while in the sectional periods t2, t4, t6 and t8, the transfer time is prolonged by 1-bit.

It will be understood easily from this figure that the effect of the invention begins to appear gradually at a point where the handling charge quantity starts to decrease, and the degree of effectiveness becomes larger with the growth of the transfer speed.

WHAT IS CLAIMED IS:

1. A driving method for a solid-state image sensing device having a plurality of sensor portions being disposed two-dimensionally in a horizontal and a vertical directions, and a vertical charge transfer portion being disposed between said plurality of sensor portions and being provided with transfer electrodes of a plurality of systems disposed along its disposed direction, comprising the steps of:

selectively applying high level driving pulses to said transfer electrodes of said plurality of systems in respective sectional periods in a vertical transfer period; and

transferring the signal charges read out from said plurality of sensor portions in the vertical direction;

wherein a sectional period in a vertical transfer period, in which the number of systems of said transfer electrodes to be applied with high level driving pulses becomes minimum is set longer than that of the other sectional periods.

2. A driving method for a solid-state image sensing device according to claim 1, having said transfer electrodes of said plurality of systems being composed of four systems and the vertical transfer period being divided into eight sections from t1 through t8, wherein

sectional periods t2, t4, t6 and t8, those in which the number of systems of said transfer electrodes to be applied with the high level driving pulses becomes two, are set longer than the sectional periods t1, t3, t5 and t7, those in which the number of systems of said transfer electrodes to be applied with said high level driving pulses becomes three.

3. A driving method for a charge transfer device having a charge transfer portion being formed of transfer electrodes of a plurality of systems disposed in the charge transfer direction, comprising the steps of:

selectively applying a high level driving pulse to said transfer electrodes of said plurality of systems in respective sectional periods in a transfer period; and

transferring signal charges in a charge transfer portion;

wherein a sectional period in said transfer period, in which the number of systems of said transfer electrodes to be applied with high level driving pulses becomes minimum are set longer than that of the other sectional periods.

4. A driving method for charge transfer devices according to claim 3, having said transfer electrodes of said plurality of systems being composed of four systems and the vertical transfer period being divided into eight

sections from t1 through t8, wherein the sectional periods t2, t4, t6 and t8, those in which the number of systems of said transfer electrodes to be applied with the high level driving pulses becomes two, are set longer than the sectional periods t1, t3, t5 and t7, those in which the number of systems of said transfer electrodes to be applied with high level driving pulses becomes three.

5. A charge transfer device having a charge transfer portion being formed of transfer electrodes of a plurality of systems disposed in the charge transfer direction;

wherein high level driving pulses are applied to said transfer electrodes of said plurality of systems in respective sectional periods in a charge transfer period;

signal charges in a charge transfer portion are transferred; and

a sectional period in a charge transfer period, in which the number of systems of said transfer electrodes to be applied with high level driving pulses becomes minimum is set longer than that of the other sectional periods.

ABSTRACT OF THE DISCLOSURE

A driving method for a solid-state image sensing device having a plurality of sensor portions being disposed two-dimensionally in a horizontal and a vertical directions, and a vertical charge transfer portion being disposed between said plurality of sensor portions and being provided with transfer electrodes of a plurality of systems disposed along its disposed direction, including the steps of; selectively applying high level driving pulses to the transfer electrodes of said plurality of systems in respective sectional periods in a vertical transfer period, and transferring the signal charges read out from said plurality of sensor portions in the vertical direction, wherein a sectional period in a vertical transfer period, in which the number of systems of the transfer electrodes to be applied with high level driving pulses becomes minimum is set longer than that of the other sectional periods. It is thus made possible to increase the handling charge quantity in the vertical charge transfer portion without changing time for transfer in the vertical transfer period.

S99P0924

FIG.1

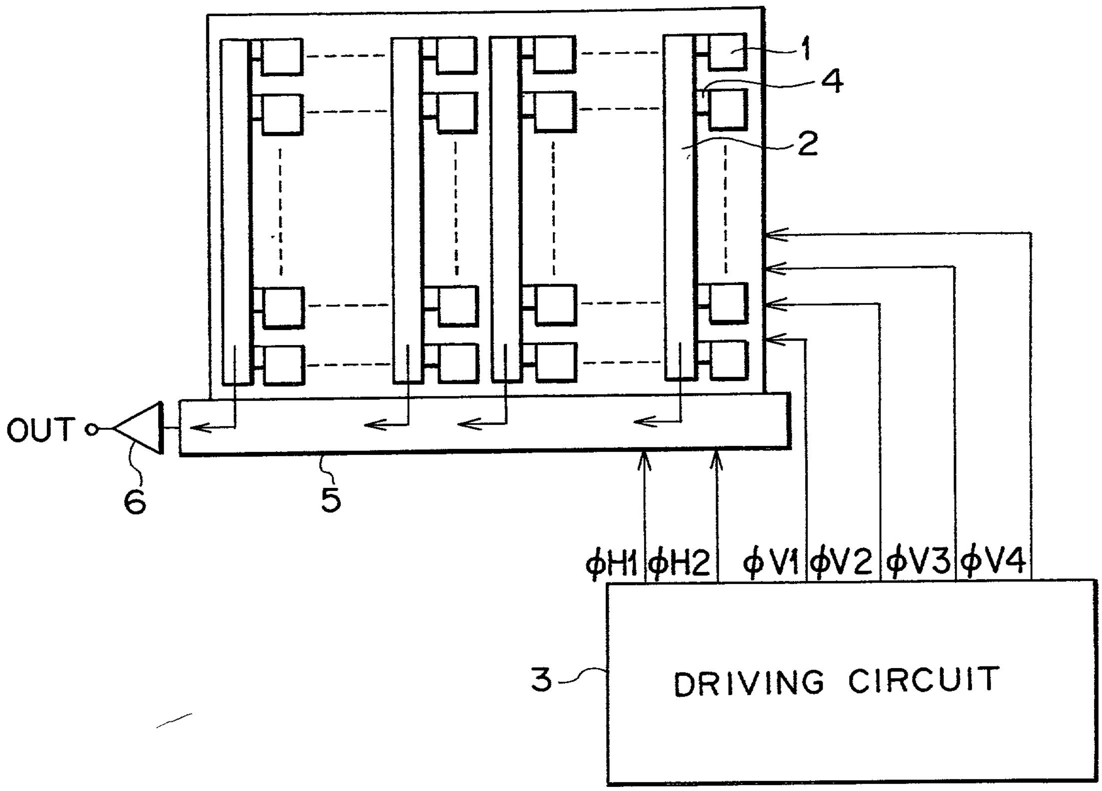


FIG.2

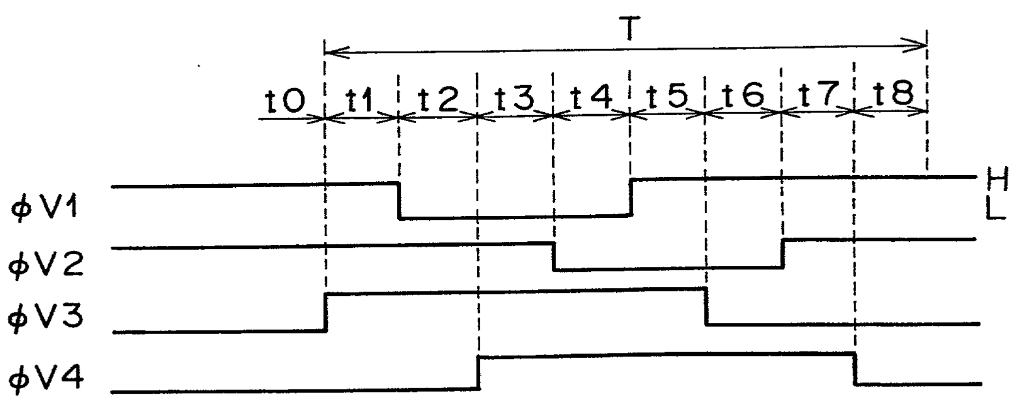
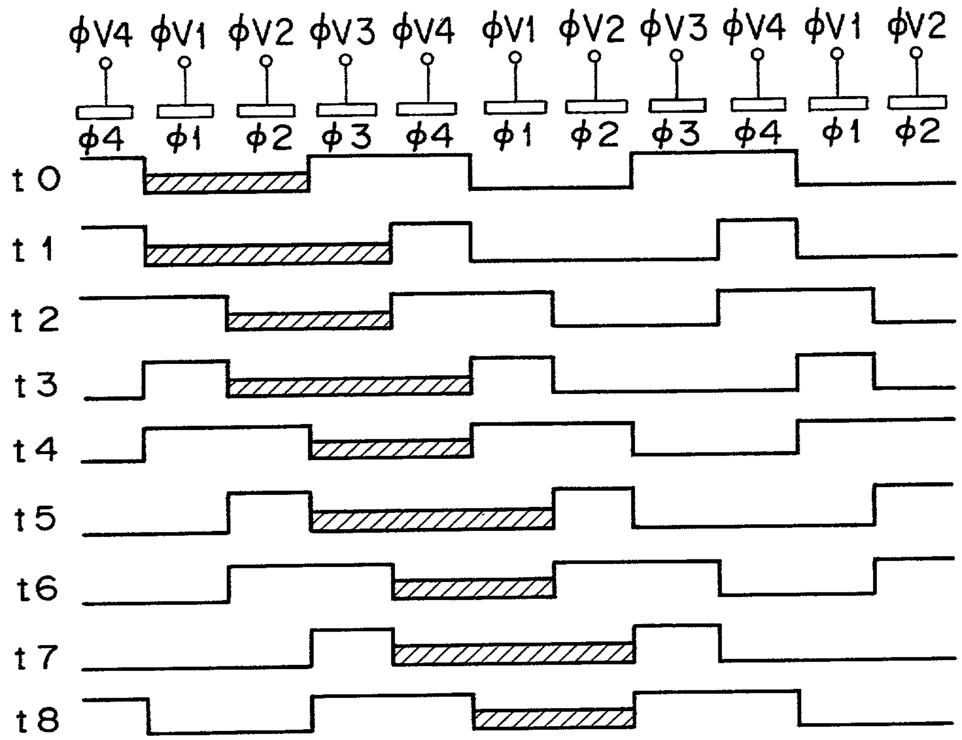
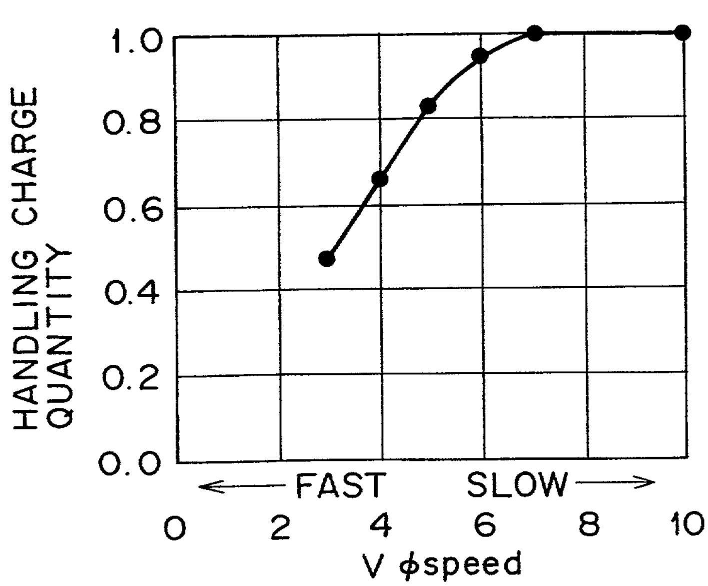


FIG. 3



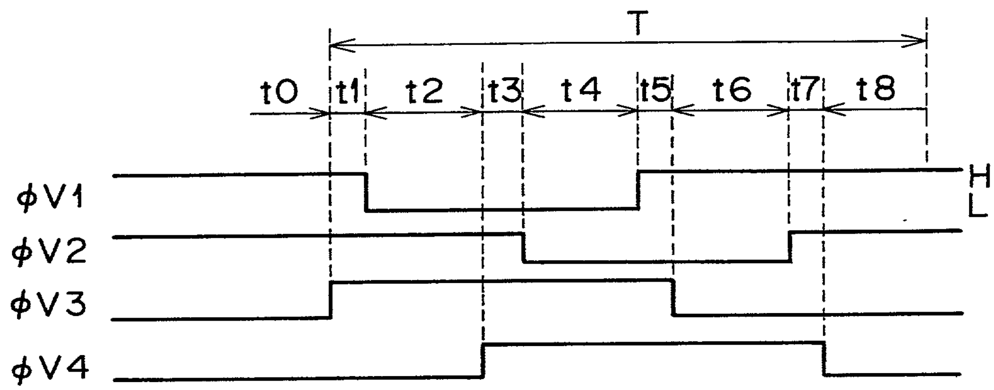
φV4 φV1 φV2 φV3 φV4 φV1 φV2 φV3 φV4 φV1 φV2
φ4 φ1 φ2 φ3 φ4 φ1 φ2 φ3 φ4 φ1 φ2
t0
t1
t2
t3
t4
t5
t6
t7
t8

FIG. 4



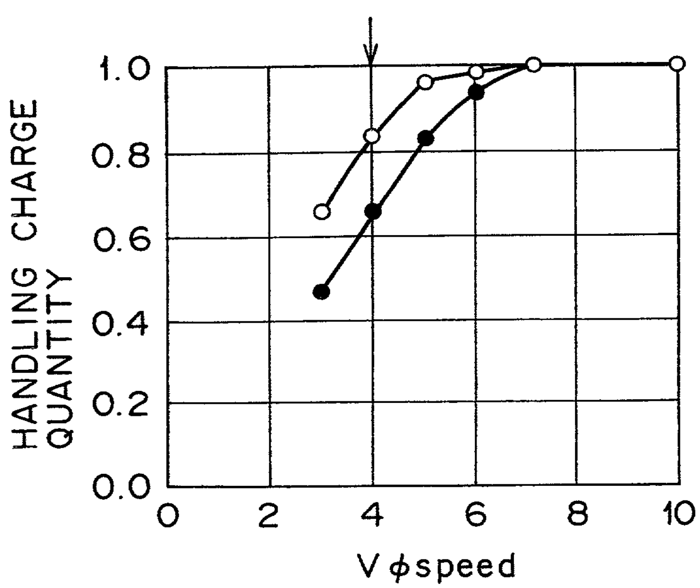
HANDLING CHARGE QUANTITY
1.0
0.8
0.6
0.4
0.2
0.0
← FAST
SLOW →
0
2
4
6
8
10
V φspeed

FIG. 5



T
t0
t1
t2
t3
t4
t5
t6
t7
t8
φV1
φV2
φV3
φV4
H
L

FIG. 6



HANDLING CHARGE QUANTITY
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
Vφspeed

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A CHARGE TRANSFER DEVICE AND A DRIVING METHOD THEREOF AND A DRIVING METHOD FOR SOLID-STATE IMAGE SENSING DEVICE

Case No. P99,0601, the specification of which

(check one)	X	is attached hereto.
	___	was filed on ____________, as Application Serial No. ____________ and was amended on ____________. (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent Office all information which is known to me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, 1.56(a).[1]

I do not know and do not believe this invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and I believe that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as identified below:

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below

Prior Foreign Application(s)

Number	Country	Date
P10-156944	Japan	June 5, 1998

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[1] *(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and*

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the above listed application on which priority is claimed:

Prior Foreign Application(s)

Number *Country* *Date*

If no priority is claimed, I have identified all foreign patent applications filed prior to this application:

Prior Foreign Application(s)

Number *Country* *Date*

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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